

14. (New) An interferometric measuring device for measuring surface characteristics, shapes, distances, distance variations, and vibrations, comprising:

a probe part having a measuring head at a free end of the probe part; and

an optical measuring fiber having a free end which projects out of and beyond the probe part and the measuring head toward an object to be measured, the optical measuring fiber for illuminating a point of measurement and for picking up a measuring light coming from the point of measurement.

a 15. (New) The measuring device according to claim 3, wherein:

the free end region of the fiber is at least one of: i) polished, ii) provided with a diaphragm, iii) configured as one of a lens and a prism, iv) treated against disturbing reflected light, v) beveled, vi) reflection-coated, and vii) antireflection-coated.

REMARKS

I. INTRODUCTION

Claims 14 and 15 have been added. Claims 1-15 are now pending in the above-identified application. The Specification has been amended. Claims 2, 4 and 5 have been amended to clarify the subject matter recited therein. No new matter has been added. Reconsideration of the present application is requested.

II. OBJECTIONS TO THE SPECIFICATION

The Examiner has objected to the Specification because the Examiner due to various alleged informalities. Applicant has amended the Specification to address noted informalities.

III. OBJECTION TO THE CLAIMS

The Examiner has objected to claim 2 because the Examiner believes the claim includes an extraneous comma. Applicant has amended claim 2 to delete the comma.

Applicant acknowledges the Examiner's indication that Applicants' second claim 12 has been renumbered to be claim 13.

IV. REJECTION OF CLAIMS 4 AND 5 UNDER 35 U.S.C. § 112, SECOND PARAGRAPH

Claims 4 and 5 stand rejected under 35 U.S.C. § 112, second paragraph, because the Examiner believes that these claims are indefinite. Claims 4 and 5 have been amended to clarify the subject matter recited therein. It is respectfully submitted that claims 4 and 5 are now definite.

V. REJECTION OF CLAIMS 1-4 AND 6-8 UNDER 35 U.S.C. § 102(b)

Claims 1-4 and 6-8 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,134,003 to Tearney et al. (the "'003 patent"). It is respectfully submitted that none of claims 1-4 and 6-8 is anticipated by the '003 patent, for at least the following reasons.

Claim 1 recites, inter alia, "in the measuring head, at a free end of the probe part approaching a measuring object, **the optical fiber projects out**" (Emphasis added.) Claims 3, 4 and 6-8 depend from claim 1. Respectfully, the '003 patent does not teach an optical fiber projecting out of a measuring part, at a free end of the probe part approaching the measuring object. The Examiner apparently relies on optical system 54 and endoscopic unit 34 of the '003 patent as disclosing Applicant's recited measuring head and probe part, respectively. Respectfully, the optical fiber 44 does not project out of the optical system 54 at a free end of the endoscopic unit approaching a measuring object. Figures 4 and 6, for example, appear to show that the optical fiber 44 is contained within the optical system 54.

As regards claim 4, the Examiner relies on lens 56. Respectfully, claim 4 recites that the free end region (of the fiber) is one of 8 different options, one of which is "configured as one of a lens and a prism." In the '003 patent, the free end of the fiber 44 is not *configured* as lens 56 -- lens 56 appears to be a completely separate part.

In view of at least the foregoing, it is respectfully submitted that none of claims 1-4 and 6-8 is anticipated by the '003 patent. Withdrawal of the rejection of claims 1-4 and 6-8 under 35 U.S.C. § 102(b) as being anticipated by the '003 patent is, therefore, requested.

VI. REJECTION OF CLAIMS 5, 9, 10 AND 13 UNDER 35 U.S.C. § 103

Claims 5, 9, 10 and 13 stand rejected under 35 U.S.C. § 103 as being obvious over the '003 patent. It is respectfully submitted that none of claims 5, 9, 10 and 13 is obvious over the '003 patent, for at least the following reasons.

As an initial matter, claims 5, 9, 10 and 13 depend from claim 1. Accordingly the arguments presented above in connection with claim 1 and the '003 patent apply equally to claims 5, 9, 10 and 13. Moreover, the '003 patent does not even suggest, for example, "in the measuring head, at a free end of the probe part approaching a measuring object, ***the optical fiber projects out . . .***," as recited in claim 1. (Emphasis added.)

Additionally, as regards more specifically to claim 5, the Examiner asserts that applying a drop of adhesive to a fiber to achieve beam shaping or beam guidance is well known. Respectfully, Applicant submits that this feature is not obvious, at least in the context of the present claims. Respectfully, in accordance with the example embodiments of the present invention, the free end of an optical fiber is configured so as to be able to emit light and pick up a measuring light. In the example embodiment described in the present applicaiton, separate lens/mirrors, such as used in

the systems of the '003 patent, are not utilized at the free end of the fiber. This allows, for example, interferomic measuring in very narrow spaces. Nothing within the '003 patent suggests this, nor does the '003 patent suggest that a drop of adhesive be applied to the fiber. The '003 patent likely utilizes both a lens 56 and a "beam director" 58 for any shaping.

The Examiner has not supported the assertion regarding the adhesive with any prior art. It is respectfully requested that the Examiner cite a reference which provides the suggestion for the adhesive in combination with the system of the '003 patent. If the rejection is based on facts within the Examiner's personal knowledge, the Examiner is requested to provide Applicant with an affidavit supporting such facts. See, e.g., MPEP 2144.03.

In view of the foregoing, it is respectfully submitted that none of claims 5, 9, 10 and 13 is obvious over the '003 patent. Withdrawal of the rejection is requested.

VII. REJECTION OF CLAIMS 11 AND 12

Claims 11 and 12 stand rejected under 35 U.S.C. § 103 as being obvious over the '003 patent in view of U.S. Patent No. 6,490,046 to Dradbarek (the "'046 patent"). It is respectfully submitted that neither of claims 11 or 12 is obvious over the '003 patent in view of the '046 patent, for at least the following reasons.

Claims 11 and 12 depend from claim 1. Accordingly, the arguments presented above in connection with claim 1 and the '003 patent apply equally to claims 11 and 12. The '046 patent does not cure the deficiencies of the '003 patent.

Withdrawal of the rejection of claims 11 and 12 under 35 U.S.C. § 103 as being obvious over the '003 patent in view of the '046 patent is requested.

VIII. NEW CLAIMS

Claims 14 and 15 have been added. No new matter has been added. Claim 14 recites, for example, "an optical

measuring fiber having a free end which projects out of and beyond the probe part and the measuring head toward an object to be measured, the optical measuring fiber for illuminating a point of measurement and for picking up a measuring light coming from the point of measurement." Claim 15 depends from claim 14. As discussed above in connection with claim 1, in the '033 patent, the optical fiber 44 appears to be contained within the optical system 54 (the element upon which the Examiner has apparently relied as regards Applicant's recited measuring head). Accordingly, a free end of the fiber does not project out of and beyond a probe part and a measuring head. None of the other cited references disclose this feature. For at least this reason, it is respectfully submitted that claims 14 and 15 are also in condition for allowance.

IX. CONCLUSION

All issues raised by the Examiner have been addressed. It is respectfully submitted that all pending claims are in condition for allowance. Prompt reconsideration and allowance of the present application are therefore earnestly solicited.

Respectfully submitted,

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AMENDMENT VERSION WITH MARKINGS SHOWING CHANGES MADE

IN THE SPECIFICATION:

Please amend the specification as follows:

On page 1, please replace the paragraph beginning on line 2 with the following:

--The present invention is directed to an interferometric measuring device having a probe part and an optical fiber. The measuring device is for measuring surface characteristics, shapes, distances, and distance variations, e.g., vibrations, in particular in narrow, hollow spaces[, of measuring objects[, having a probe part and an optical fiber].--.

On page 4, please replace the paragraph beginning on line 9 with the following:

--The Figure shows an interferometric measuring device 1 having a probe part 2 and, remotely therefrom, a demodulation interferometer 3 that is connected via an optical fiber 2.7". The probe part has a fixed probe part 2.1 and, rotationally mounted thereon, a rotatable probe part 2.2, which, at [it] its front region facing a measuring object 5, is designed as a measuring head 2.3.--.

On page 5, please replace the paragraph beginning on line 4, with the following:

--Similarly to the modulation interferometers described in the publications mentioned at the outset, the demodulation interferometer includes a delay element 3.1, modulators [3.1] 3.2, 3.2', e.g., acoustooptical modulators, a spectral element 3.3, a photodetector array 3.4, and light-guide elements 3.5, 3.5'.--.

On page 5, please replace the paragraph beginning on line 22 (extending to page 6, line 1) with the following:

--Demodulation interferometer 3 is constructed, for example, in accordance with the principle of a MachZehnder interferometer. In the demodulation interferometer, the light is split into two beams. In one arm of the demodulation interferometer, delay element [1] 3.1, e.g., a plane-parallel glass plate is used. It cancels the difference which had been forced between the optical paths of the two beam components in measuring head 2.3. The two light beams are shifted in frequency with respect to each other by modulators [2] 3.2, 3.2'. The frequency difference amounts, for example, to a few kHz. The two beam components, which are capable of interference, are superposed in beam splitter 3.5, coupled out, dispersed by spectral element 3.3, e.g., a grating or prism or filter, into a plurality of colors (wavelengths: $\lambda_1, \lambda_2, \dots \lambda_n$), and focused at photodetector array 4. Each photodetector supplies an electric signal having the differential frequency produced by modulators [2] 3.2, 3.2' and a phase $\Delta\phi$ which relates to measured quantity ΔL (distance to measuring object 5) and to corresponding wavelength λ_v : $\Delta\phi = (2 \cdot \pi / \lambda_n) \cdot \Delta L$...

IN THE CLAIMS:

Please amend the claims as follows:

2. (Amended) The measuring device according to claim 1, wherein:

the surface characteristics, shapes, distances, distance variations, and vibrations are measured in narrow, hollow spaces[,] of the measuring object.

4. (Amended) The measuring device according to claim 3, wherein:

... the free end region of the fiber is one of: i) polished, ii) provided with a diaphragm, iii) configured as one of a lens and a prism, iv) treated against disturbing reflected light, v) beveled, vi) reflection-coated, vii) antireflection-coated, and viii) provided with a combination of being polished, provided with the diaphragm, configured as one of the lens and the prism, treated against disturbing reflected light, beveled, reflection-coated, and antireflection-coated.

5. (Amended) The measuring device according to claim 4, wherein:

[in order to achieve one of a beam shaping and a beam guidance,] the free end region of the fiber is at least one of: i) provided with a drop of adhesive, and ii) roughened.

Please add the following new claims:

14. (New) An interferometric measuring device for measuring surface characteristics, shapes, distances, distance variations, and vibrations, comprising:

a probe part having a measuring head at a free end of the probe part; and

an optical measuring fiber having a free end which projects out of and beyond the probe part and the measuring head toward an object to be measured, the optical measuring fiber for illuminating a point of measurement and for picking up a measuring light coming from the point of measurement.

15. (New) The measuring device according to claim 3, wherein:

the free end region of the fiber is at least one of: i) polished, ii) provided with a diaphragm, iii) configured as one of a lens and a prism, iv) treated against disturbing reflected light, v) beveled, vi) reflection-coated, and vii) antireflection-coated.